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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample is included. (AG)

ED 060105

TECHNICAL REPORT

ON

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

ASSEMBLER, DRY CELL BATTERY 9-00.91

B-310
or
S-66

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
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U. S. Employment Service in
Cooperation with
Wisconsin State Employment Service

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STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY FOR ASSEMBLER, DRY CELL BATTERY 9-00.91

B-310 or S-66

Summary

The General Aptitude Test Battery, B-1002A, was administered for a longitudinal design test development study to all of the workers who were hired by the Marathon Battery Company, Wausau, Wisconsin, for the occupation of Assembler, Dry Cell Battery between the period of June 1953 and October 1954. The final sample consisted of 94 women. The criterion consisted of rank order supervisory ratings which were expressed in broad categories. On the basis of mean scores, standard deviations, correlations with the criterion, job analysis data and their combined selective efficiency, Aptitudes K-Motor Coordination, F-Finger Dexterity and M-Manual Dexterity were selected for inclusion in the test norms.

GATB Norms for Assembler, Dry Cell Battery 9-00.91 - B-310 or S-66

Table I shows, for B-1001 and B-1002, the minimum acceptable score for each aptitude included in the test norms for Assembler, Dry Cell Battery 9-00.91.

TABLE I

Minimum Acceptable Scores on B-1001 and B-1002 for B-310 or S-66

B-1001			B-1002		
Aptitude	Tests	Minimum Acceptable Aptitude Score	Aptitude	Tests	Minimum Acceptable Aptitude Score
T	CB-1-G CB-1-K	75	K	Part 8	80
F	CB-1-O CB-1-P	85	F	Part 11 Part 12	80
M	CB-1-M CB-1-N	80	M	Part 9 Part 10	80

Effectiveness of Norms

The data in Table IV indicate that 16 of the 25 poor workers, or 64 percent of them, did not achieve the minimum scores established as cutting scores on the recommended test norms. This shows that 64 percent of the poor workers would not have been hired if the recommended test norms had been used in the selection process. Moreover, 61 of the 70 workers who made qualifying test scores, or 87 percent, were good workers.

TECHNICAL REPORT

I. Problem

This study was conducted to determine the best combination of aptitudes and minimum scores to be used as norms on the General Aptitude Test Battery for the occupation of Assembler, Dry Cell Battery 9-00.91.

II. Sample

During the period of June 1953 to October 1954, the entire GATB, B-1002A, was administered for a longitudinal experimental design test development study to 107 women applicants at the Marathon Battery Company, Wausau, Wisconsin. These women were pretested with the GATB before being hired, but were hired without regard to test scores. Thirteen of the women were eliminated from the sample because at the time the criterion data were collected, they had not been employed long enough for the supervisors to rate them validly. This resulted in a final sample of 94 women employed as Assemblers, Dry Cell Battery 9-00.91.

Two weeks of experience is considered the minimum length of time for the workers to learn this job. All of the women included in the sample had at least one month of experience at the time the criterion data were collected. Although there are no education requirements, those in the sample had at least a sixth grade education. Hiring was done by means of a personal interview and a check of references.

Table II shows the means, standard deviations, Pearson product-moment correlations (corrected for broad categories) with the criterion and the standard errors of correlation for age, education and experience. The data shown for experience pertain to experience of the sample at the time that the criterion data were collected.

TABLE II

Means (M), Standard Deviations (σ), Ranges, Pearson Product-Moment Correlations (Corrected for Broad Categories) with the Criterion ($_{c}r$), and the Standard Errors of Correlation ($\sigma_{c}r$) for Age, Education, and Experience

Assembler, Dry Cell Battery 9-00.91
N = 94

	M	σ	Range	$_{c}r$	$\sigma_{c}r$
Age (years)	29.0	9.1	18-51	.026	.103
Education (years)	9.6	1.9	6-14	.097	.102
Experience (months)	3.9	3.4	1-14	.216*	.098

*Significant at the .05 level

The correlations between age or education and the criterion are not significant. However, the correlation of .216 between experience and the criterion is significant at the five percent level. The criterion was not corrected to nullify the influence of experience because the ratings were expressed in broad categories and the statistical correction technique used for this purpose was not applicable. In addition, some factors indicated that perhaps the correction would not be warranted even if the statistical technique were applicable. The workers in this occupation were subject to lay-off and recall depending upon orders received by the company. In most instances, hiring was done in large groups. Lay-offs were according to seniority. When workers had equal seniority, the poorer workers were usually laid off before the better workers, and the better workers were usually recalled before the poorer workers. This resulted in some of the better workers having more experience than the poorer ones. To the extent that this is true, the correlation between experience and the criterion reflects a true difference in job performance ability between the more and less experienced workers and correction of the criterion to nullify the influence of experience would not be warranted.

III. Job Description

Job Title: Assembler, Dry Cell Battery 9-00.91

Job Summary: Assembles various parts of dry cell batteries, performing one or more of the following assembly line operations. Places battery core into battery can. Places cells into compartments of partitioned box which has been immersed in hot asphalt and bends attached wire of each cell over center cap of adjacent cell. Applies soldering flux to wires and bends down each wire so that it makes contact with center cap of adjacent cell.

Work Performed

Fills battery cans: Removes tray of cans from center conveyor. Places paper liner over battery can with left hand and picks up battery core from an outside conveyor with right hand; inserts core into battery can and forces liner under and around core. Places tray back on center conveyor when all of the cans are filled.

Assembles cells: Reaches to an upper shelf for partitioned box which has been immersed in hot asphalt and places it on work table. Picks up cell or cells from the conveyor with left hand, transfers them to right hand and places one cell into each compartment of box. Bends attached wire of each cell over the center cap of adjacent cell, using right hand, and simultaneously reaches for additional cells on conveyor with left hand.

Connects wires: Applies soldering flux to wires with special soldering tool, by tamping and scraping tool over entire top surface of battery unit to deposit flux on wires. Bends the wire of each cell down so that it makes contact with the center cap of adjacent cell, using pliers. Occasionally presses wires down with index finger of left hand.

IV. Experimental Battery

All of the parts of the GATB, B-1002A, were administered to the sample group.

V. Criterion

The criterion data were collected in the fall of 1954 when all of the workers in the sample had at least one month of experience. It consisted of supervisory ratings made by five foremen who were in charge of the workers. Three of these foremen supervised the day shift workers and the other two the night shift workers. In only a few instances did one foreman rate workers who were presently working for another foreman and these ratings were consistent. The raters were asked to rate the workers on the quality and quantity of their work. Each rater ranked the workers under his supervision in the order of their ability and divided the workers into three categories, above average, average and below average as compared to workers in this occupation "in general." No attempt was made to have each rater divide the group of workers he rated into thirds because of the unequal number of workers rated by each foreman. The ratings of the five foremen were combined by grouping together all of the workers rated above average, average and below average in their respective categories. For statistical purposes these broad category ratings were converted into quantitative scores. The above average group with 25 workers, the average group with 44 workers and the below average group with 25 workers received scores of 62, 50 and 38 respectively.

VI. Statistical and Qualitative Analysis

Table III shows the means, standard deviations, Pearson product-moment correlations (corrected for broad categories) with the criterion, and standard errors of correlation for the aptitudes of the GATB. The means and standard deviations of the aptitudes are comparable to general population norms with a mean of 100 and a standard deviation of 20.

TABLE III

Means (M), Standard Deviations (σ), Pearson Product-Moment Correlations (Corrected for Broad Categories) with the Criterion ($_{c}r$) and Standard Errors of Correlation ($\sigma_{c}r$) for the Aptitudes of the GATB

Assembler, Dry Cell Battery 9-00.91
N = 94

Aptitudes	M	σ	$_{c}r$	$\sigma_{c}r$
G-Intelligence	90.7	13.4	.112	.102
V-Verbal Aptitude	90.3	12.5	.197	.099
N-Numerical Aptitude	90.7	15.7	.094	.102
S-Spatial Aptitude	94.4	16.5	.107	.102
P-Form Perception	97.6	17.8	.266**	.096
Q-Clerical Perception	97.5	15.7	.158	.101
K-Motor Coordination	96.4	15.8	.453**	.082
F-Finger Dexterity	101.1	19.2	.483**	.079
M-Manual Dexterity	100.0	18.4	.502**	.077

** Significant at the .01 level

The statistical results were interpreted in the light of the job analysis data. The job analysis indicated that the following aptitudes measured by the GATB appear to be important for this occupation:

Form Perception (P) - required to determine whether wire is in direct contact with center cap.

Motor Coordination (K) - required in positioning paper spider over battery can quickly and accurately and in inserting cells into each compartment of crate.

Finger Dexterity (F) - required in using fingers to pick up battery core and in bending wires in the proper direction.

Manual Dexterity (M) - required in using hands and arms in reaching and picking up trays from conveyor, and in handling pliers to pinch and twist the wire down to make contact with the center cap.

The highest mean scores were obtained in descending order of magnitude for Aptitudes F, M, P, Q and K, respectively. All of the aptitudes have standard deviations of less than 20 with Aptitude V exhibiting the smallest standard deviation.

When N = 94, correlations of .264 and .203 are significant at the .01 level and the .05 level, respectively. Aptitudes P, K, F and M correlate significantly with the criterion at the .01 level of confidence.

Aptitudes P, K, F and M were considered for inclusion in the test norms on the basis of the qualitative and quantitative factors cited above: all four of these aptitudes appeared to have some importance in terms of job analysis data, showed relatively high mean scores and were significantly correlated with the criterion. A tetrachoric correlation was computed for trial norms consisting of Aptitudes P, K, F and M with cutting scores set at one standard deviation unit below their respective mean scores, rounded to the nearest five point score levels. Since Aptitude P tended to lower the selective efficiency of these norms, Aptitude P was not included in the final test norms.

For the final test norms the cutting scores for Aptitudes K, F and M were set one standard deviation unit below their respective mean scores and rounded to nearest five point score levels. Setting cutting scores at these levels yielded the best selective efficiency for the norms and resulted in a critical score of 80 for each of the aptitudes.

VII. Predictive Validity of Norms

For the purpose of computing the tetrachoric correlation coefficient between the test norms and the criterion and applying the Chi Square test, the criterion was dichotomized with those workers who were rated "above average," and "average" in job performance placed in the high criterion group. Those workers who were rated "below average" were placed in the low criterion group.

Table IV shows the relationship between the dichotomized criterion and test norms consisting of Aptitudes K, F and M each with a score of 80 for Assembler, Dry Cell Battery 9-00.91. Workers in the high criterion group have been designated as "good workers" and those in the low criterion group as "poor workers."

TABLE IV

Relationship between Test Norms Consisting of Aptitudes K, F, and M, each with Critical Scores of 80 and the Criterion for Assembler, Dry Cell Battery 9-00.91

N = 94

	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Workers	8	61	69
Poor Workers	16	9	25
Total	24	70	94

$r_{tet} = .78$ $\quad X^2 = 23.823$

$\sigma_{r_{tet}} = .19$ $\quad P/2 < .0005$

The data in the above table indicate a high and significant relationship between the test norms and the criterion for this sample.

VIII. Conclusions

On the basis of mean scores, correlation coefficients, job analysis data and their combined selective efficiency, Aptitudes K, F and M each with a minimum score of 80 are recommended as B-1002 norms for the occupation of Assembler, Dry Cell Battery 9-00.91. The equivalent B-1001 norms consist of T-75, F-85 and M-80.